A hand bore three miles south of the homestead sunk to a depth of a little over a hundred feet, carried good fresh water but yields too small a supply to be of use for stock. Three wells, shown on the Lands litho. about nine miles south of the homestead, are said to have struck fresh water but seem not to have been developed. One of these is probably identical with the "Sisters Well" shown on the Kimberley Downs Pastoral Company's private map, the other two being apparently unknown to the present manager.

About two and a half miles east of the homestead on the south bank of a small creek, which parallels the sandstone scarp on which the homestead is built, a shallow hand bore has revealed fresh water but an insufficient supply. At a point about two and a half miles north of the 52-mile point on the telegraph line three shallow hand bores revealed the existence of small supplies of salt water.

Two wells, two and a half miles north and eight miles south-east, respectively, of Mt. North have been sunk and carry good supplies of fresh water. These wells have been improved by the erection of crude oil engines and pumping jacks. They are known as the Mungee Wheeler well and the Barnes' well.

Artesian or sub-artesian supplies of water should be available at moderate depth anywhere in the area examined which is, say, ten miles down dip from the outcrop of the sedimentary beds in the Napier Range. Closer to the Range than this there is risk of disappointment, as it is too close to the outcrop of the porous beds for the water to have developed any hydrostatic head.

Within this ten-mile strip close to the Range much perhaps could be done by sinking shallow wells and obtaining the necessary quantity of water to keep a pump running by putting in drives at the bottom. The presence of fresh water at shallow depth in widely separated localities, such as the Halfway Bore and Mungee Wheeler and Barnes' Wells, suggests that good wells could be obtained almost anywhere within this strip of country. Before sinking wells the sites should first be tested by hand boring.

The experience of the Meda Pastoral Company, who have in one bore passed through 1,100 feet of shale carrying intensely saline water, and who have met with shale continuously in other bores put down, indicates that there is a thick shale horizon within this area.

The bore now being put down by the Kimberley Downs Pastoral Company at the Telephone Dam is apparently close to the northern edge of this shale member of the series. A shallow hand bore put down about two miles to the north was almost wholly in sandstone, with only a few thin shale bands. The Telephone Dam bore started in shale and has continued with little change to its present depth of 800 feet. Taking into consideration the low dips observable at Mt. Marmion and the fact that the base of this shale must be somewhere south of the hand bore two miles to the north of the Telephone Dam, this bore should now be very nearly through the shale and should then pass into the sandstones met with in the hand bore further north, from which a good supply of water is to be expected.

Assuming a 4deg. dip for this shale bed and that the outcrop is two miles to the north of the bore site, the bore should have passed into a water-bearing sand at approximately 740 feet.* The results of boring up to date have not borne out this theory, and the only reason which can be advanced for this failure is that sub-surface dips in the vicinity of the bore are steeper than those observable at Mt. Marmion.

If boring operations in this area are considered in the future it would be well to locate any bore site to the north of the shale horizon and thus avoid the cost of penetrating it; the water in the shale itself being too saline for watering stock.

4.—THE UNDERGROUND WATER SUPPLY AT POINT WALTER RECREATION RESERVE.

(F. G. Forman, B.Sc.)

Following a request from the chairman State Gardens Board, I was instructed to investigate the water supply possibilities at the Point Walter Recreation Reserve.

The Point Walter reserve is situated on the south side of the Swan River facing Freshwater Bay, and distant from Perth and Fremantle about eleven miles and three miles by road respectively.

Like most of the metropolitan area, the rocks in this locality consist of limestones and calcareous sandstones, overlain by drift sand. False bedding of the sandstone is common and at several horizons subrecent fossil shells occur. The sandstones and limestones are in places cavernous, as evidence the number of small caves situated close to the water level and opening out in the cliffs which face Blackwall Reach on the western side of the reserve.

How far these caves extend is not known, as the openings are usually too small to be accessible, and even where they are accessible the caves soon become too narrow and too low for further travel. That these caves are undoubtedly water channels is evidenced by deposits of brown clay on the floors on which the marks caused by running water are plainly seen. They probably carry streams in wet weather. Along Blackwall Reach there are numerous fresh water springs issuing from the cliffs at or just below high water mark.

Two wells have been sunk on the reserve. One of these is situated near the foreshore on the northern side of the reserve close to the jetty. No reliable information relative to the quality of the water from this source is obtainable, as the well is now inaccessible; the brick lining having been removed and the well filled in. It is said that the water was unusable owing to a high salt content.

The second well is situated on the top of a hill near the centre of the reserve. The water level in this well is 92 feet below the collar of the shaft, and at the time of my inspection there was about three feet of water standing in the bottom. From the irregular shape of the bottom it is suspected that the well was at one time deeper, and that it has been partly filled in.

* Since writing this report water was actually struck at 868ft. and rose to within 23ft. of surface.

A sample of the water from the well, on analysis by the Government Mineralogist and Analyst, gave the following result:—

Total soluble salts	192.4 grains per gal.
Sodium chloride (calculated from chlorine)	154.7 grains per gal.
Magnesium	5.3 grains per gal.

Reaction pH 7.5 neutral.

A comment at the end of the Analyst's report states that this water is too saline for irrigating any crops other than those highly resistant to salt.

With a view to obtaining further information on the quality of the underground water in this locality two further water samples were taken and sent for analysis.

The first of these samples was taken from a disused well 59 feet deep, situated on private property at the corner of Stock Road and Matheson Road, just outside the eastern boundary of the reserve. The result of the analysis is as follows:—

Total soluble salts	41.3 grains per gal.
Sodium chloride	23.8 grains per gal.

Reaction pH 7.7.

The Analyst states that this water is of good quality for irrigating lawns or gardens.

The second of these samples was obtained from a well 23 feet deep on Mr. R. H. Mackenzie's property in Kent Street, just outside the southern boundary of the reserve and about three chains from the foreshore of Blackwall Reach. The result of the analysis of this sample is as follows:—

Total soluble salts	58.8 grains per gal.
Sodium chloride	34.3 grains per gal.

Reaction pH 7.3.

The Analyst states that this water is of good quality for irrigating lawns or gardens.

The water level in this well is influenced by tides, but the quality of the water is said not to suffer. Mr. Mackenzie uses this water for irrigation and prefers it for this purpose to the scheme water.

It is the experience of residents in this locality and of other places adjacent to the foreshores of the lower reaches of the Swan River that fresh water may be obtained by sinking almost anywhere above high water mark, and also that great care must be exercised not to sink too far below the water table as brackish water, probably a soakage from the river, will nearly always then be obtained.

The salinity of the water in the deep well on Point Walter Reserve is certainly too high for irrigation, but whether this was so when water was first struck is not known. It may be that the present salinity is due to the well having been made too deep, thus allowing underlying brackish water access to the well.

The wells from which the second and third samples were taken have only about a foot to eighteen inches of water in them and the supply is consequently small, but in each case the well sinker has avoided the lower saline level.

The usual practice, when an increased supply is required, is to obtain it by putting in drives of the requisite length and being careful that only the top foot or eighteen inches of the water-bearing stratum is drawn on.

Recommendations.—It is not advisable to seek a supply of fresh water by deepening the existing well. Such a course would involve shutting off the brackish water at present in the well, and owing to the very porous nature of the rocks this would be difficult. Also, the well might have to be deepened considerably before a suitable sub-artesian supply could be obtained.

It is suggested that an attempt be made to improve the supply by crosscutting eastwards, say ten feet, from the cuddy which has already been excavated at the bottom of the well; using the spoil to fill up the old sump. The quality of the water should then be tested by a hand bore at the inner end of the crosscut, and in the event of the water being suitable for irrigation, the supply could be obtained by driving at the water level from this crosscut, care being taken that the water bearing beds be not disturbed for more than a foot or eighteen inches below the water level. This method would make use of the existing shaft and would only involve the expense of, say, 30 feet of crosscutting and driving. It is probable that no timbering would be required, as the bottom of the well is in solid sandstone and self-supporting. The necessary crosscut would be utilised as a pump chamber. The length of drive to be excavated would depend on the supply of water required, but probably would not be more than twenty feet.

The alternative to repairing the existing well is to sink a new shaft in a different locality. A suitable site for a new shaft would appear to be in a small gully crossed by the tram line and west of the present deep well. The water should be obtained here at a depth of approximately 50 feet. From this site approximately 600 feet of piping would be required to convey the water to the existing tennis courts and gardens. At this site, owing to the cavernous nature of the sandstones along the foreshore, there may be some risk of pollution by river water conveyed to the well through open channels; but judging from the number of fresh water springs flowing from the foot of the cliffs and from the experience of well owners to the south of the reserve, this would seem not to be great.

An alternative site for a well is near the crest of the hill on the reserve. This being close to well No. 2 where the water yielded an excellent analysis, would very probably give a good quality water. A shaft at this point would need to be approximately 75 feet deep to strike the water, and approximately 1,320 feet of piping would be required to convey the water to the tennis courts.

If a well was sunk at either of the two suggested sites, the precautions mentioned above should be followed carefully, viz., the depth of the water in the well should not exceed 18 inches and that an increased supply should be obtained by driving and not by sinking. Also, before sinking any shaft, the site decided on should be tested by hand-boring, which would be inexpensive and would give proof of the quality of water before the expense of shaft sinking is incurred.